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Climate

African Scenarios for Climate and Energy Resilience

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Table of contents

African Scenarios for Climate and Energy Resilience 3

- Briefly 3
- The Africa Energy Policy Scenario 3
- The Sustainable Africa Scenario 4
- Energy Solutions for Sustainable Development 6

Endnotes 7

Donors and Sponsors 7

Reuse our work 7

Cite this research 7

African Scenarios for Climate and Energy Resilience

- Briefly
- The Africa Energy Policy Scenario
- The Sustainable Africa Scenario
- Energy Solutions for Sustainable Development

Briefly

To compare potential futures in energy and climate for Africa, we model and discuss the development of energy production, demand and policies, related carbon emissions, and climate change implications in two steps.

The Africa Energy Policy Scenario

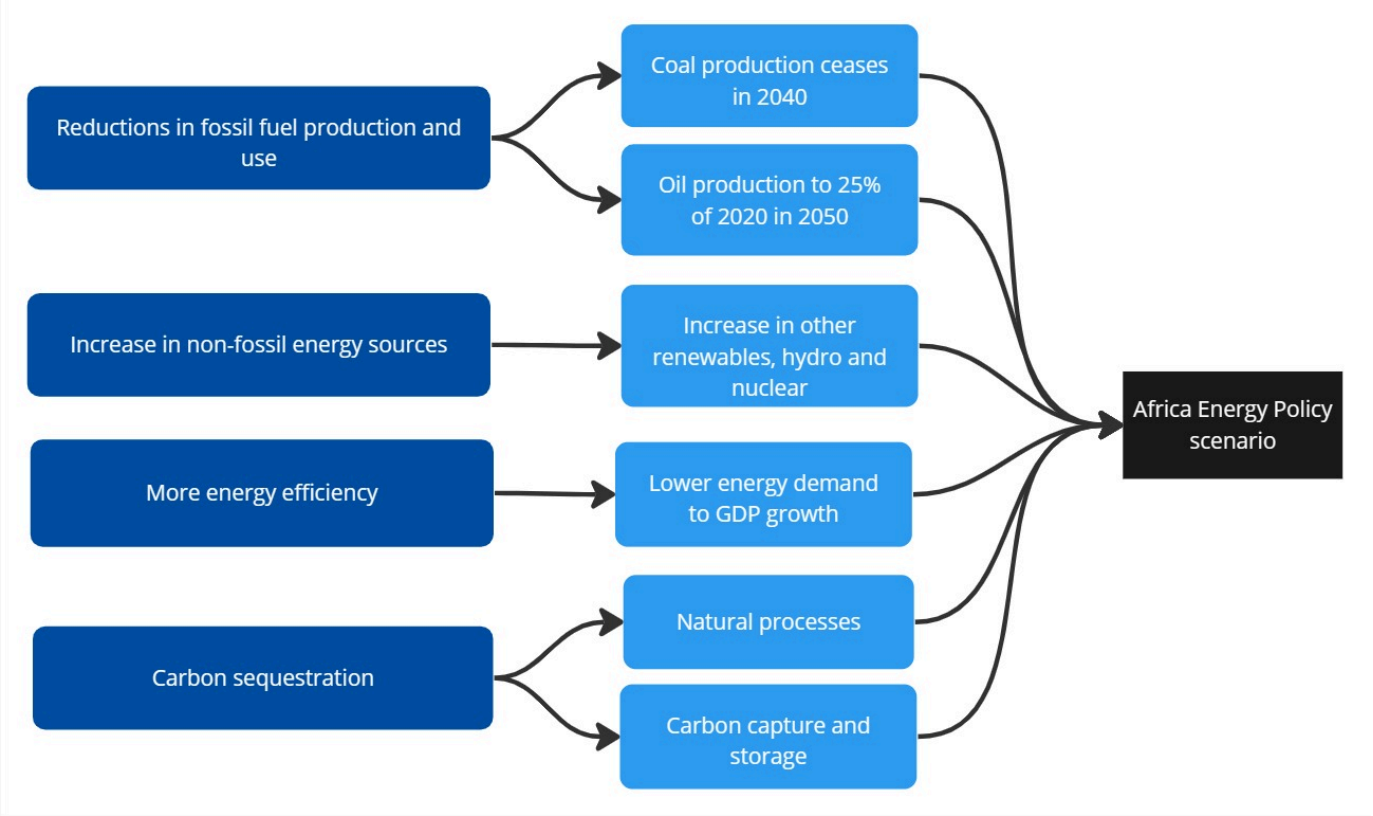
The Africa Energy Policy explores the challenges and strategies for the continent's transition to renewable energy and sustainable development, considering its current reliance on fossil fuels, the need for substantial investment, and the potential for significant environmental and social impacts.

The scenario models Africa’s energy trajectory based on the Current Path forecast , meaning the current likely development without significant shocks. It uses a framework comprising six energy types: oil, gas, coal, nuclear, hydroelectric, and other renewables. It includes the following interventions, each of which is separately discussed, benchmarked and motivated in the Energy theme:

- A drastic decrease in fossil fuel usage as recommended by UNEP:
  - Reducing coal production to zero by 2040; affecting Botswana, Mozambique, South Africa and Zimbabwe.
  - A reduction in oil production to 25% of the 2020 amounts until 2050; affecting current and future oil producers, including Algeria, Angola, Cameroon, Chad, Republic of Congo, Egypt, Ghana, Gabon, Gambia, Libya, Mozambique, Nigeria, South Sudan, Sudan, Tanzania and Uganda.
- No limitation in gas production to limit an emergent energy production shortfall.
- Additional climate change mitigation efforts including carbon capture and storage, mainly consisting of a halt in deforestation and, from 2040, forest regeneration.
- A 33% increase in other renewable energy resources, such as solar and wind as well as realistic increases in Africa’s nuclear and hydro, both coming from very low levels. The modelling increases nuclear production by 52% above the 2050 Current Path forecast and production from hydro by 13% above the 2050 Current Path forecast.
- Technological and infrastructure improvements leading to more energy efficiency and lowering Africa’s energy demand by 4.2% below the 2050 Current Path forecast.

These are all expensive interventions, particularly for the countries that will have to forego significant amounts of future revenues from fossil fuels.

Chart 14: Africa Energy Policy scenario

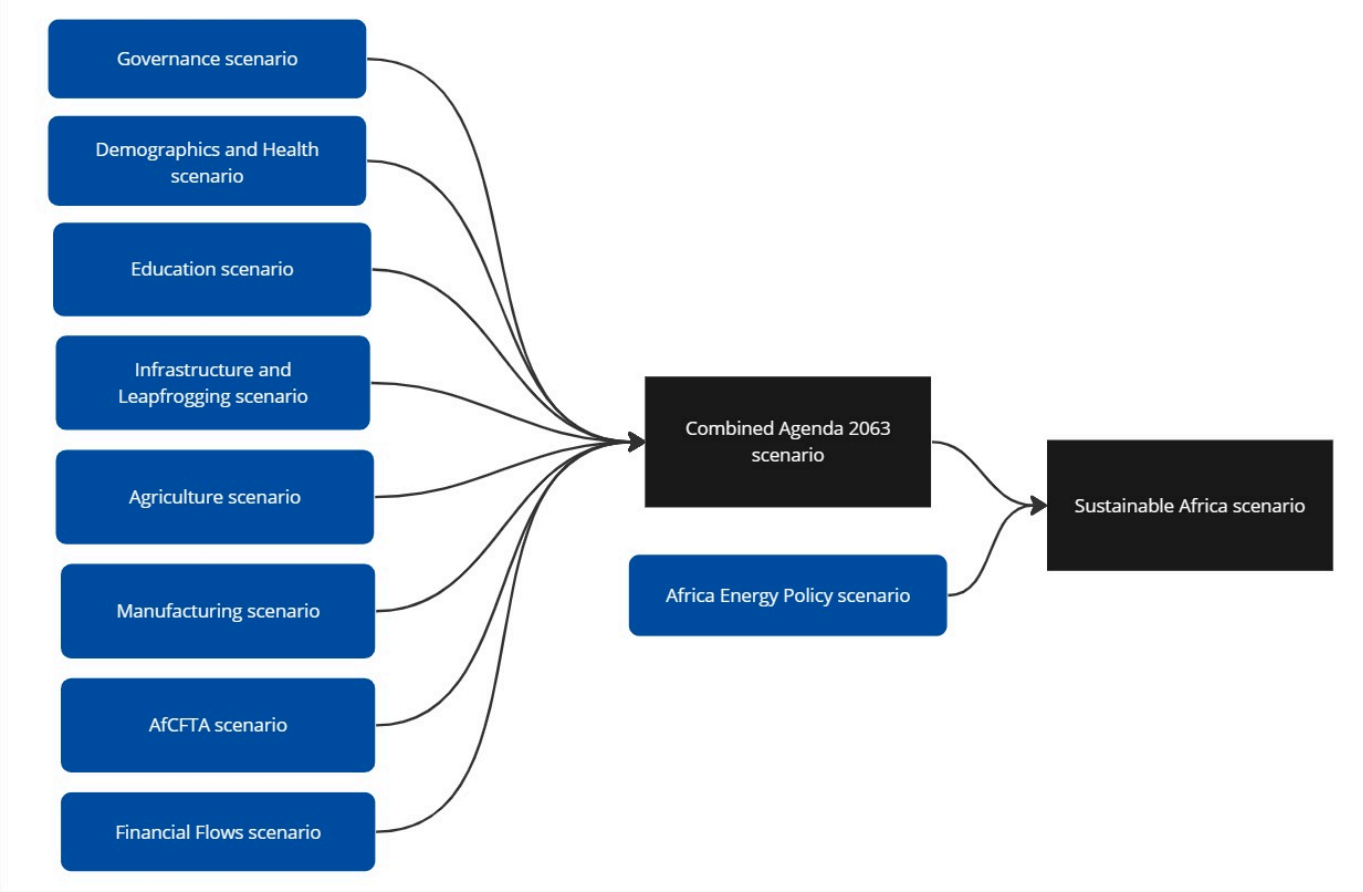


The Sustainable Africa Scenario

The Africa Energy Policy scenario reduces Africa's carbon emissions and emulates a transition to renewables. However, Africa has a larger gap between energy production and demand than in the Current Path forecast without additional poverty reductions or improvements in average incomes. Things change if Africa successfully pursues the ambitions reflected in the Combined Agenda 2063 scenario.

In the second step (Chart 14), we thus develop a Sustainable Africa scenario. It combines the Africa Energy Policy scenario with the Combined Agenda 2063 scenario, which consists of eight sectoral scenarios that advance Africa's development prospects (ranging from agriculture to manufacturing and the full implementation of the AfCFTA). One of the effects of the combined scenario is an acceleration of Africa's demographic transition to the extent that the continent would have 207 million fewer people by 2050 and 419 million fewer people in 2063 compared to the Current Path forecast.

Chart 15: Sustainable Africa Scenario



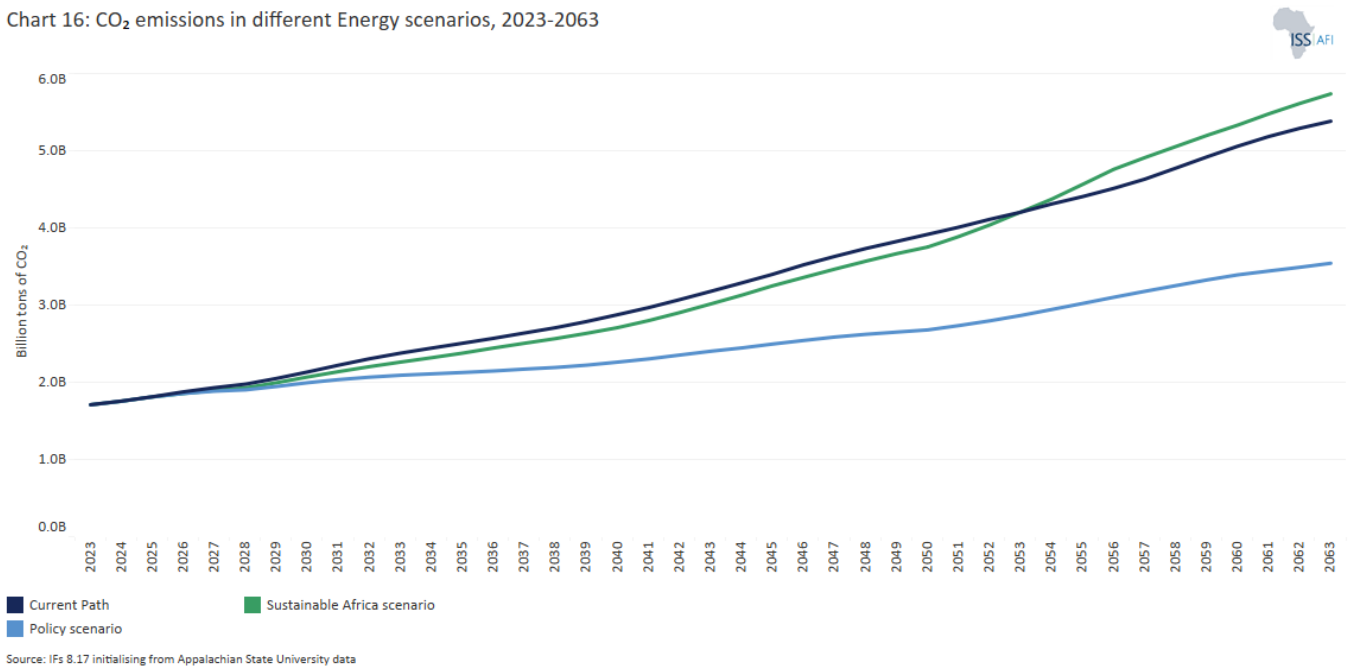
Despite the reduction in carbon emissions due to a smaller African population, the economic growth associated with the Sustainable Africa scenario would increase Carbon emissions above the Current Path forecast. This increase, however, is minimal in relation to its potential social and economic benefits and would contribute very little to global emissions (Chart 16).

The impact of the suite of policies to improve energy efficiency and constrain carbon emissions is evident when considering that Africa will, in 2050, release 4.3% less carbon from fossil fuels in the Sustainable Africa scenario compared to the Current Path forecast. However, more rapid economic growth in the Sustainable Africa scenario eventually translates into more emissions. By 2063, Africa will release 6% more carbon from fossil fuels than in the Current Path forecast.

The fulfilment of the Sustainable Africa ambition would see a 2050 African economy that is 79% larger than the Current Path forecast, GDP per capita would be 61% higher and only 105 instead of 341 million Africans living in extreme poverty. Africa's total economy would grow roughly two percentage points more rapidly than in the Current Path forecast. The differences are even more positive by 2063.

However, because of the various mitigation policies, energy demand would only be 30% higher in 2050. Instead of energy demand equivalent to 6.4 barrels of oil equivalent per person, African per capita demand would be 10.7 barrels by 2063. Thus, with the implementation of an aggressive suite of mitigation measures, Africa could grow at an average of 7% per annum (instead of 4.7% on the Current Path forecast). At the same time, its carbon emissions only increase above the Current Path forecast three decades into the future.

Chart 16: CO_2 emissions in different Energy scenarios, 2023-2063



Source: IFs 8.17 initialising from Appalachian State University data

Solutions for Sustainable Development

The impact of the mitigation and adaptation measures modelled as part of the Sustainable Africa scenario is powerful. Africa's carbon emissions from fossil fuel use are only slightly above the Current Path forecast by 2063. Although it will not be easy, Africa can embark upon a sustainable growth path to its own and global benefit - but only if it can continue to exploit its gas resources to avoid an energy and financial crisis.

Creating fuels from municipal solid waste is an important opportunity that should get more attention than is provided with the hype around the need to reduce fossil fuels and increase non-fossil energy sources. The world generates over 1.3 billion tons of municipal solid waste annually, which is expected to double by 2025. Most of this is generated in high-income countries, but low- and middle-income countries are experiencing the fastest growth. Only about 20% of municipal solid waste is collected and appropriately treated, while the rest is dumped in landfills, burned openly, or littered. Informal waste picking and recycling sectors are widespread but often operate in unsafe and unhealthy conditions. Due to rapid urbanisation , Africa is likely to see an increase in projected urban waste of up to 200% in the next decade, of which 30 to 70% is organic waste (i.e. made up of food waste or biomass) that is not only non-recyclable but also produces methane (CH_4), a potent greenhouse gas, on decomposition. Research published in Waste Management indicates that up to one ton (equivalent) of CO_2 can be saved per ton of waste combusted rather than sent to landfill due to the potency of CH_4 as a greenhouse gas. In 2016, Africa produced 174 million tonnes of municipal solid waste, projected to reach 269 million by 2030. According to UNEP, Africa generates an average of 0.72 kg of municipal solid waste per person per day, with only about half collected and the rest often dumped in landfills, burned openly or littered.

One approach would be to explore the design of small-scale, decentralised waste-to-energy plants. The downscaling of the Fischer-Tropsh synthesis in a remote context, with priority given to low capital costs, simplicity and energy self-sufficiency, offers a potential pathway in this regard.[1]

Endnotes

1. C L Tucker, Waste to Fuel: Designing a cobalt-based catalyst and process for once-through Fischer-Tropsch synthesis operated at high conversion, PhD Thesis, at the Department of Chemical Engineering, University of Cape Town, 2022.

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Cite this research

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About the authors

Ms Alize le Roux joined the AFI in May 2021 as a senior researcher. Before joining the ISS, she worked as a principal geo-informatics researcher at the CSIR, supporting various local and national policy- and decision-makers with long-term planning support. Alize has 14 years of experience in spatial data analysis, disaster risk reduction and urban and regional modelling. She has a master's degree in geographical sciences from the University of Utrecht, specialising in multi-hazard risk assessments and spatial decision support systems.

Dr Jakkie Cilliers is the ISS's founder and former executive director of the ISS. He currently serves as chair of the ISS Board of Trustees and head of the African Futures and Innovation (AFI) programme at the Pretoria oce of the ISS. His 2017 best-seller Fate of the Nation addresses South Africa's futures from political, economic and social perspectives. His three most recent books, Africa First! Igniting a Growth Revolution (March 2020), The Future of Africa: Challenges and Opportunities (April 2021), and Africa Tomorrow: Pathways to Prosperity (June 2022) take a rigorous look at the continent as a whole.

About African Futures & Innovation

Scenarios and forecasting can help Africa identify and respond to opportunities and threats. The work of the African Futures & Innovation (AFI) program at the Institute for Security Studies aims to understand and address a widening gap between indices of wellbeing in Africa and elsewhere in the world. The AFI helps stakeholders understand likely future developments. Research findings and their policy implications are widely disseminated, often in collaboration with in-country partners. Forecasting tools inspire debate and provide insights into possible trajectories that inform planning, prioritisation and effective resource allocation. Africa's future depends on today's choices and actions by governments and their non-governmental and international partners. The AFI provides empirical data that informs short- and medium-term decisions with long-term implications. The AFI enhances Africa's capacity to prepare for and respond to future challenges. The program is headed by Dr Jakkie Cilliers.